

CMS data analysis - Hands on

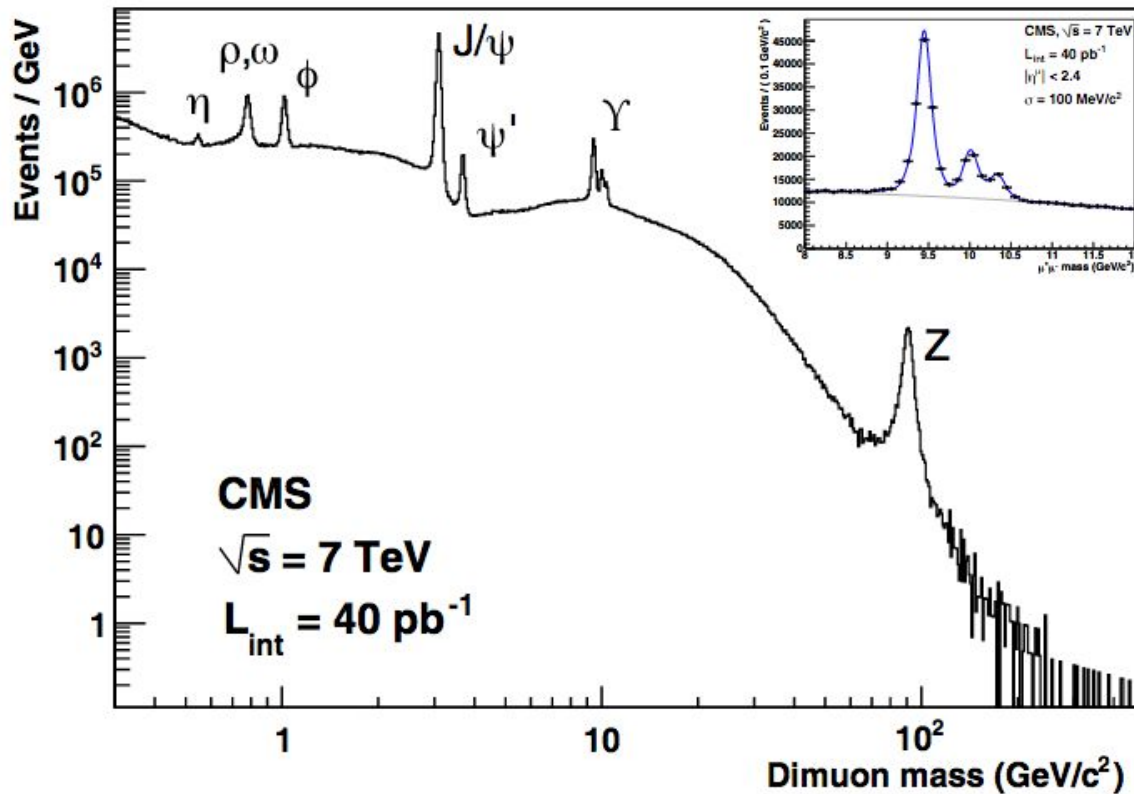
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Invariant mass distribution



CMS - coordinate system

CMS DETECTOR

Total weight : 14,000 tonnes
Overall diameter : 15,0 m
Overall length : 28,7 m
Magnetic field : 3.8 T

STEEL RETURN YOKE
12,500 tonnes

SILICON TRACKERS
Pixel (100x150 μm) $\sim 16\text{m}^2 \sim 66\text{M}$ channels
Microstrips (80x180 μm) $\sim 200\text{m}^2 \sim 9.6\text{M}$ channels

SUPERCONDUCTING SOLENOID
Niobium titanium coil carrying $\sim 18,000\text{A}$

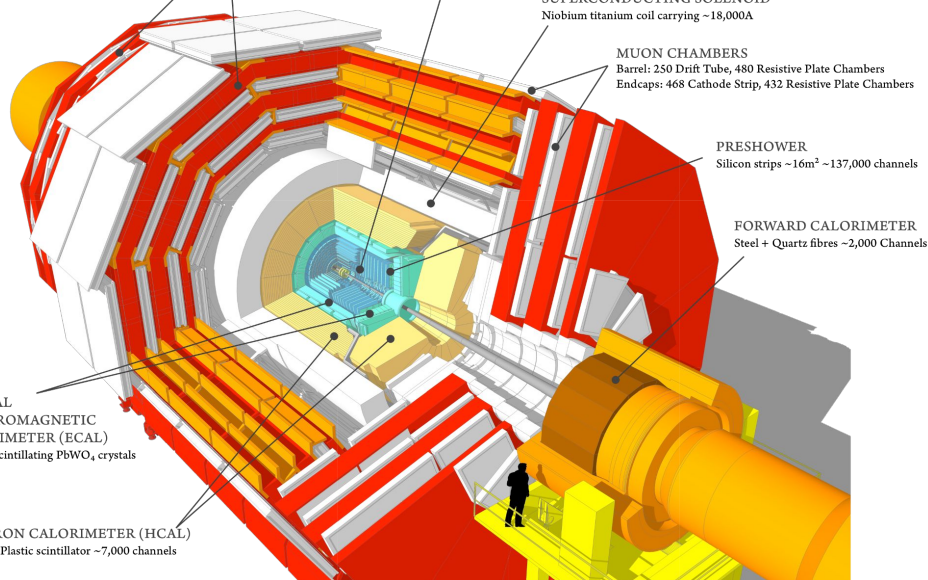
MUON CHAMBERS
Barrel: 250 Drift Tube, 480 Resistive Plate Chambers
Endcaps: 468 Cathode Strip, 432 Resistive Plate Chambers

PRESHOWER
Silicon strips $\sim 16\text{m}^2 \sim 137,000$ channels

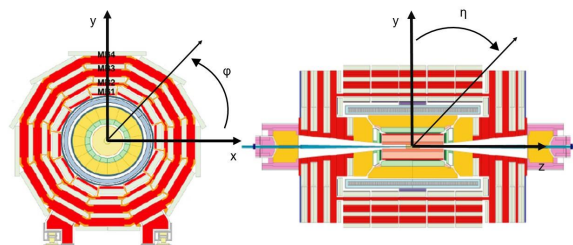
FORWARD CALORIMETER
Steel + Quartz fibres $\sim 2,000$ Channels

CRYSTAL
ELECTROMAGNETIC
CALORIMETER (ECAL)
 $\sim 76,000$ scintillating PbWO_4 crystals

HADRON CALORIMETER (HCAL)
Brass + Plastic scintillator $\sim 7,000$ channels



- Cylindrical coordinate system with origin at the interaction point



- The angular distribution of particles - rapidity

$$y = \frac{1}{2} \ln \left(\frac{E + p_z}{E - p_z} \right) \xrightarrow{p \gg m} \eta = -\ln \left(\tan \frac{\theta}{2} \right)$$

- The angular distance between particles:

$$\Delta R = \sqrt{\Delta\phi^2 + \Delta\eta^2}$$

CMS - pseudorapidity

